

CLAIMS:

1. A method for generating a registered image of a body part of a patient for use in a computer aided surgical procedure, the method comprising:
 - 5 attaching a marker detectable by a tracking system to the body part prior to any surgical steps of the surgical procedure, the tracking system having a reference frame;
detecting the position of the marker in the reference frame;
capturing at least a first image of the body part using an imaging system;
obtaining an indication of the position of the first image relative to the reference
10 frame of the tracking system; and
determining a mapping to bring the first image into registration with the position of the body part.
2. The method as claimed in claim 1, and further comprising mapping the first image
15 into registration with the position of the body part in the reference frame of the tracking system.
3. The method as claimed in claim 1 or 2, wherein obtaining an indication of the position of the at least first image relative to the reference frame of the tracking system
20 includes detecting the position in the reference frame of the tracking system of a further marker attached to a part of the imaging system using the tracking system.
4. The method as claimed in claim 1 or 2, wherein the first image includes the marker and at least a part of the body part, wherein the position of the marker is detected
25 when the first image is captured thereby providing the indication.
5. The method as claimed in any of claims 2 to 4, and further comprising displaying the registered image during the computer aided surgical procedure.
- 30 6. The method as claimed in claim 5, wherein the surgical procedure is an orthopaedic procedure.

7. The method as claimed in claim 1, wherein attaching the marker includes implanting the marker in a bone of the patient.

8. The method as claimed in claim 7, wherein implanting the marker includes
5 percutaneously implanting the marker.

9. The method as claimed in any preceding claim, wherein the marker is wirelessly detectable at radio frequencies by the tracking system.

10 10. The method as claimed in any preceding claim, wherein the imaging system is an X-ray system.

11. The method as claimed in claim 11, wherein the position of the marker is detected with the patient standing.

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12. The method as claimed in any preceding claim, wherein the marker is wirelessly tracked using a magnetic tracking system.

13. The method as claimed in any of claims 10 to 12, wherein obtaining an indication
20 of the position of the at least first image relative to the reference frame of the tracking system includes determining the position of an X-ray detector in the reference frame of the tracking system.

14. The method of any of claims 10 to 13, and further comprising capturing a second
25 image of the body part using the X-ray system, and wherein the second image is in a second direction different to a first direction in which the first image was captured.

15. The method as claimed in claim 14, wherein capturing the second image includes moving the patient relative to the X-ray system.

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16. The method as claimed in claim 14, wherein capturing a second image includes moving an X-ray source relative to the patient and the method further comprises

determining the position of the X-ray source in the reference frame of the tracking system when the second image is captured.

17. The method as claimed in claim 14, wherein the first image is captured using a
5 first X-ray source and wherein capturing the second image includes using a second X-ray source at a second position which is different to a first position of the first X-ray source.

18. The method as claimed in claim 14 and further comprising generating a three
10 dimensional image of the body part from the first and second images.

19. The method as claimed in claim 10 and further comprising determining the
distance between the body part and an imaging plane of an X-ray detector along a
direction perpendicular to the plane of the imaging plan and using the distance to correct
the first image captured by the X-ray detector.

15 20. The method as claimed in any of claims 1 to 9, wherein the imaging system is a CT scan or an MR scan system.

21. The method as claimed in claim 20, wherein the body part of the patient is located
20 on a patient support part of the imaging system when the first image is captured and further comprising determining the position of the patient support part in the reference frame of the tracking system.

22. The method as claimed in claim 21, and further comprising mounting a marker
25 detectable by the tracking system on the patient support part.

23. The method as claimed in claim 20, wherein the body part of the patient is located
on a patient support part of the imaging system when the first image is captured and
further comprising determining the position of an imaging plane of the scan system
30 relative to the position of the patient support part.

24. The method as claimed in claim 20, wherein the first image includes the marker

and at least a part of the body part and wherein the position of the marker is detected when the first image is captured.

25. The method as claimed in any preceding claim and further comprising:
5 attaching a further marker detectable by the tracking system to a further body part prior to any surgical steps of the image guided surgical procedure; and
detecting the position of the further marker in the tracking reference frame.

26. The method as claimed in claim 25, and wherein mapping the first image into
10 registration with the position of the body part includes using the position of the further marker.

27. A system for generating a registered image of a body part of a patient for use in an image guided surgical procedure, the system including:
15 an imaging system for capturing at least a first image of the body part;
a tracking system for detecting a marker and determining the position of the marker in a reference frame of the tracking system;
a marker attachable to the body part of the patient and detectable by the tracking system; and
20 a computer control system configured to obtain an indication of the position of the first image relative to the reference frame of the tracking system and to determine how to map the first image into registration with the position of the body part.

28. A system as claimed in claim 27, wherein the marker is wirelessly detectable by
25 the tracking system.

29. A system as claimed in claim 28, wherein the marker is wirelessly detectable by the tracking system at radio frequencies.

30. A system as claimed in any of claims 27 to 29, wherein the marker is percutaneously implantable in a bone of the patient.

31. A system as claimed in any of claims 27 to 30, and further comprising a further marker detectable by the tracking system, and wherein the further marker is mounted on a part of the imaging system.
- 5 32. A system as claimed in any of claims 27 to 31, wherein the imaging system is an X-ray imaging system including an X-ray source and an X-ray detector having an imaging plane.
33. A system as claimed in claim 32, and further comprising a second marker
10 detectable by the tracking system, and wherein the second marker is mounted on the X-ray detector.
34. A system as claimed in claim 32 or 33, and further comprising a third marker detectable by the tracking system, and wherein the third marker is mounted on the X-ray
15 source and wherein the X-ray source is movable relative to the X-ray detector.
35. A system as claimed in claim 32 or 33, and further comprising:
a fourth marker detectable by the tracking system; and
a further X-ray source, and wherein the fourth marker is mounted on the further
20 X-ray source.
36. A system as claimed in any of claims 32 to 35, wherein the marker is a magnetically detectable and trackable marker.
- 25 37. A system as claimed in any of claims 32 to 36, wherein the computer control system is further configured to determine a separation between the marker and an imaging plane of the X-ray detector and to use the separation to correct the first image.
38. A system as claimed in any of claims 27 to 31, wherein the imaging system is a
30 CT scan or MR scan imaging system.
39. A system as claimed in claim 38, and further comprising a second marker

detectable by the tracking system, and wherein the imaging system includes a patient support part and the second marker is mounted on the patient support part.

40. A system as claimed in claim 38, wherein the computer control system is further
5 configured to determine the position of the patient when the first image includes the marker and at least a part of the body part.

41. A system as claimed in claim 38, wherein the imaging system includes a patient
support part and wherein the computer control system determines the position of an
10 imaging plane of the imaging system relative to the patient support part.

42. A system as claimed in any of claims 27 to 41, and further comprising a further
marker attachable to a further body part of the patient and detectable by the tracking
system.

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43. A computer implemented method for generating a registered image of a body part
of a patient bearing a marker detectable by a tracking system having a reference frame,
the registered image being for use in an image guided surgical procedure and being
generated prior to any surgical steps of the image guided surgical procedure, the method
20 comprising:

determining the position of the marker in the reference frame;

determining the position of a first image of the body part relative to the reference
frame of the tracking system, wherein the first image was captured by an imaging system;
and

25 determining a mapping to bring the first image into registration with the position
of the body part.

44. A method as claimed in claim 43, wherein the first image includes a further body
part of the patient bearing a further marker detectable by the tracking system, and the
30 method further comprising determining the position of the further marker in the reference
frame.

45. A method as claimed in claim 43 or 44, wherein determining the position of the first image of the body part includes determining the position of a further marker detectable by the tracking system and attached to a part of the imaging system.
- 5 46. A method as claimed in claim 43 or 44, wherein determining the position of the first image includes determining the position of an imaging plane of the imaging system relative to a patient support part of the imaging system.
47. A method as claimed in claim 43, 44 or 46, wherein determining the position of a
10 first image of the body part relative to the reference frame includes determining the position of an image of at least a part of the marker in the first image.
48. A method as claimed in any of claims 43 to 47, and further comprising displaying the registered image.
- 15 49. Computer program code executable by a data processing device to provide a system as claimed in any of claims 27 to 42 or a method as claimed in any of claims 43 to 48.
- 20 50. A computer readable medium bearing computer program code as claimed in claim 49.